

Supporting information

Synthesis, characterization and cytolytic activity of α -helical amphiphilic peptide nanostructures containing crown ethers

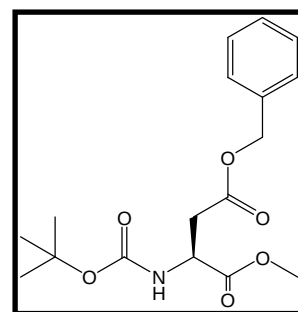
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Boc-Asp(OBzl)-OMe

m/z (IC): 338 = (M+H)⁺, 355 = (M+NH₄)⁺

White solid, mp 64°C

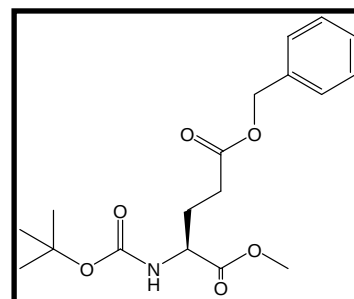


δ_H (400 MHz; CDCl₃) 1.40 (9H, s, *t*-butyl) 2.81-3.07 (2H, m, CH₂(β)) 3.67 (3H, s, COOCH₃) 4.55-4.60 (1H, m, CH₂) 5.09 (1H, d, CH-Ph, *J* 4.0) 5.11 (1H, d, CH-Ph, *J* 4.0) 5.44 (1H, d, NH, *J* 7.9) 7.27-7.37 (5H, m, Ph, *J* 7.9)

Boc-Glu(OBzl)-OMe

m/z (IC): 352 = (M+H)⁺, 369 = (M+NH₄)⁺

White solid, mp 44°C

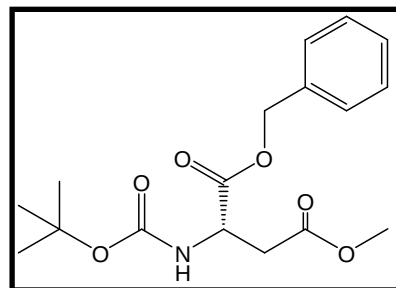


δ_H (400 MHz; CDCl₃) 1.40 (9H, s, *t*-butyl) 1.87-2.22 (2H, m, CH₂(β)) 2.33-2.50 (2H, m, CH₂(γ)) 3.71 (3H, s, COOCH₃) 4.29-4.37 (1H, m, CH(α)) 5.07 (1H, d, NH, *J* 7.9) 5.1 (2H, s, CH₂-Ph) 7.25-7.37 (5H, m, Ph)

Boc-Asp(OMe)-OBzl

m/z (IC): $338 = (M+H)^+$, $355 = (M+NH_4)^+$

White solid, mp 66°C

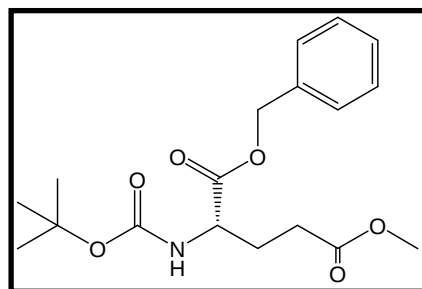


δ_H (400 MHz; CDCl₃) 1.40 (9H, s, *t*-butyl) 2.72-2.90 (2H, m, CH_{2(β)}) 3.60 (3H, s, COOCH₃) 4.55-4.63 (1H, m, CH_(α)) 5.13 (1H, d, CH-Ph, *J* 10.0) 5.16 (1H, d, CH-Ph, *J* 10.0) 5.51 (1H, d, NH, *J* 7.9) 7.30-7.36 (5H, m, Ph, *J* 7.9)

Boc-Glu(OMe)-OBzl

m/z (IE): $352 = (M+H)^+$, $369 = (M+NH_4)^+$

White solid, mp 51°C

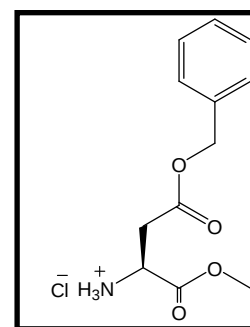


δ_H (400 MHz; CDCl₃) 1.40 (9H, s, *t*-butyl) 1.87-2.22 (2H, m, CH_{2(β)}) 2.33-2.50 (2H, m, CH_{2(γ)}) 3.62 (3H, s, COOCH₃) 4.25-4.29 (1H, m, CH_(α)) 5.12 (2H, d, NH, *J* 7.9 Hz) 5.13 (1H, s, CH₂-Ph) 7.24-7.37 (5H, m, Ph)

⁺NH₃-Asp(OBzl)-OMe

m/z (IC): $238.2 = (M+H)^+$

White solid, mp 138°C

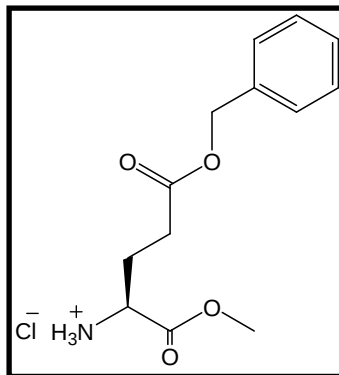


δ_H (400 MHz; CDCl₃) 3.20-3.39 (2H, m, CH_{2(β)}) 3.65 (3H, s, COOCH₃) 4.54 (1H, s, CH_(α)) 5.14 (2H, s, CH₂-Ph) 7.30-7.37 (5H, m, Ph) 8.87 (3H, s, NH₃)

⁺NH₃-Glu(OBzl)-OMe

m/z (IC): 252 = (M+H)⁺

White solid, mp 129°C

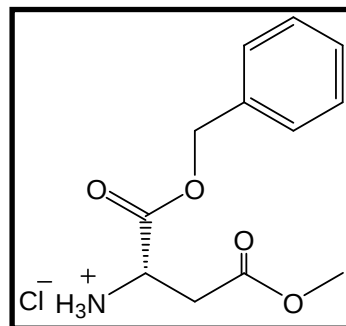


δ_{H} (400 MHz; CDCl₃) 2.35-2.43 (2H, m, CH₂(β)) 2.57-2.77 (2H, m, CH₂(γ)) 3.68 (3H, s, COOCH₃) 4.21-4.32 (1H, m, CH(α)) 5.05 (1H, d, CH-Ph, *J* 1.9) 5.07 (1H, d, CH-Ph, *J* 1.9) 7.23-7.29 (5H, m, Ph) 8.79 (3H, s, NH₃)

⁺NH₃-Asp(OMe)-OBzl

m/z (IC) : 238 = (M+H)⁺

White solid, mp 128°C

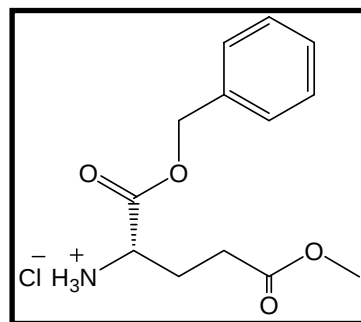


δ_{H} (400 MHz; CDCl₃) 3.18-3.32 (2H, m, CH₂(β)) 3.60 (3H, s, COOCH₃) 4.58 (1H, s, CH(α)) 5.15 (1H, d, CH-Ph, *J* 12.0) 5.20 (1H, d, CH-Ph, *J* 12.0) 7.27-7.32 (5H, m, Ph) 8.85 (3H, s, NH₃)

⁺NH₃-Glu(OMe)-OBzl

m/z (IC) : 254.2 = (M+H)⁺

White solid, mp 139°C

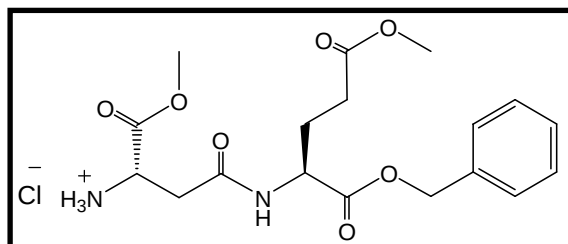


δ_{H} (400 MHz; CDCl₃) 2.33-2.41 (2H, m, CH₂(β)) 2.50-2.69 (2H, m, CH₂(γ)) 3.55 (3H, s, COOCH₃) 4.28-4.33 (1H, m, CH(α)) 5.16 (1H, s, CH₂-Ph) 7.24-7.32 (5H, m, Ph) 8.85 (3H, s, NH₃)

⁺NH₃-β-Asp(OMe)-Glu(OMe)-OBzl

m/z (IC) : 381.4 = (M+H)⁺

White solid, mp 162°C

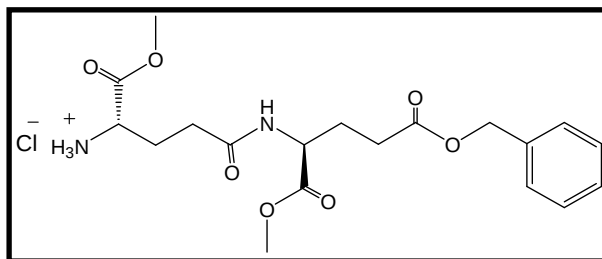


δ_H (400 MHz; CDCl₃) 1.73-2.04 (2H, m, CH₂(β)) 2.27-2.35 (2H, m, CH₂(γ)) 2.71-2.84 (2H, m, CH₂(β) (Asp)) 3.52 (3H, s, COOCH₃) 3.64 (3H, s, COOCH₃) 4.23-4.28 (1H, m, CH_(α)) 4.30-4.37 (1H, m, CH_(α)) 5.04-5.11 (2H, m, CH₂-Ph) 7.24-7.40 (5H, m, Ph) 8.29 (3H, s, NH₃) 8.67-8.71 (1H, d, NH, *J* 7.9)

⁺NH₃-γ-Glu(OMe)-Glu(OBzl)-OMe

m/z (IC) : 395.2 = (M+H)⁺

White solid, mp 129°C

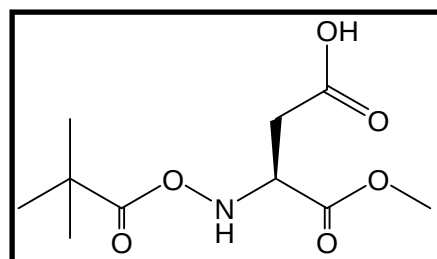


δ_H (400 MHz; CDCl₃) 1.92-2.18 (2H, m, CH₂(β)) 2.20-2.44 (2H, m, CH₂(β)) 2.38-2.45 (2H, m, CH₂(γ)) 2.51-2.63 (2H, m, CH₂(γ)) 3.61 (3H, s, COOCH₃) 3.69 (3H, s, COOCH₃) 4.14-4.20 (1H, m, CH_(α)) 4.40-4.50 (1H, m, CH_(α)) 5.03 (2H, s, CH₂-Ph) 7.21-7.30 (5H, m, Ph) 7.51-7.58 (1H, d, NH, *J* 7.8) 8.62 (3H, s, NH₃)

Boc-Asp(OH)-OMe

m/z (IC) : 248.3 = (M+H)⁺

White solid, mp 87°C

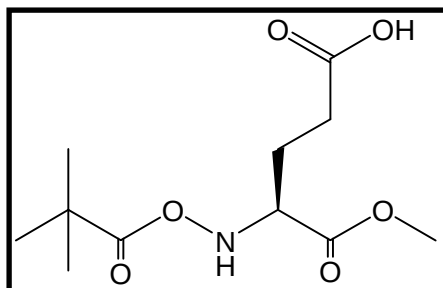


δ_H (400 MHz; CDCl₃) 1.42 (9H, s, *t*-butyl) 2.78-3.06 (2H, m, CH₂(β)) 3.46 (3H, s, COOCH₃) 4.50-4.61 (1H, m, CH_(α)) 5.42-5.55 (1H, d, NH, *J* 7.9)

Boc-Glu(OH)-OMe

m/z (IC) : 261.3 = (M+H)⁺

Colourless oil

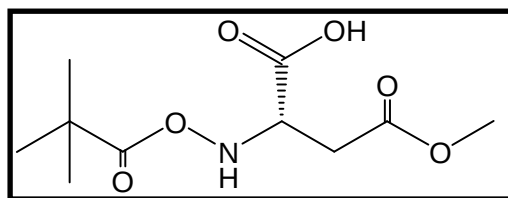


δ_H (400 MHz; CDCl₃) 1.40 (9H, s, *t*-butyl) 1.76-2.20 (2H, m, CH₂(β)) 2.34-2.46 (2H, m, CH₂(γ)) 3.70 (3H, s, COOCH₃) 4.29-4.37 (1H, m, CH(α)) 5.18 (1H, d, NH, *J* 7.9)

Boc-Asp(OMe)-OH

m/z (IC) : 248.3 = (M+H)⁺

White solid, mp 56°C

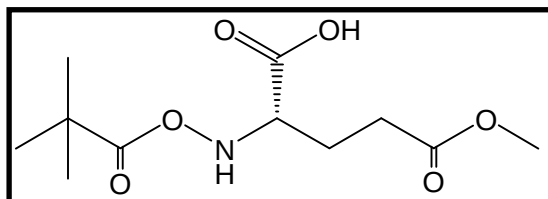


δ_H (400 MHz; CDCl₃) 1.41 (9H, s, *t*-butyl) 2.76-3.10 (2H, m, CH₂(β)) 3.68 (3H, s, COOCH₃) 4.56-4.64 (1H, m, CH(α)) 5.54-5.58 (1H, d, NH, *J* 7.9) 10.91 (5H, s, OH)

Boc-Glu(OMe)-OH

m/z (IC) : 262.3 = (M+H)⁺

White solid, mp 66°C

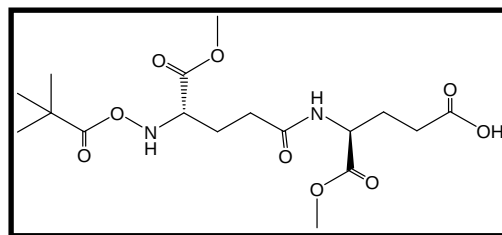


δ_H (400 MHz; CDCl₃) 1.40 (9H, s, *t*-butyl) 1.90-2.22 (2H, m, CH₂(β)) 2.33-2.50 (2H, m, CH₂(γ)) 3.62 (3H, s, COOCH₃) 4.25-4.32 (1H, m, CH(α)) 5.18-5.24 (2H, s, NH, *J* 7.8)

Boc- γ -Glu(OMe)- γ -Glu-OMe

m/z (IC) : 405 = (M+H)⁺

White solid, mp 72°C

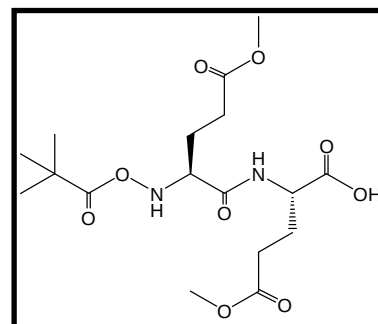


δ_H (400 MHz; CDCl₃) 1.40 (9H, s, *t*-butyl) 1.78-2.04 (2H, m, CH₂(β)) 2.10-2.22 (2H, m, CH₂(β)) 2.27-2.31 (2H, m, CH₂(γ)) 2.36-2.42 (2H, m, CH₂(γ)) 3.70 (3H, s, COOCH₃) 3.73 (3H, s, COOCH₃) 4.20-4.27 (1H, m, CH(α)) 4.57-4.62 (1H, m, CH(α)) 5.41 (1H, d, NH, *J* 8.1) 6.80 (1H, d, NH, *J* 7.9)

Boc-Glu(OMe)-Glu(OMe)-OH

m/z (IC) : 405 = (M+H)⁺

Colorless oil

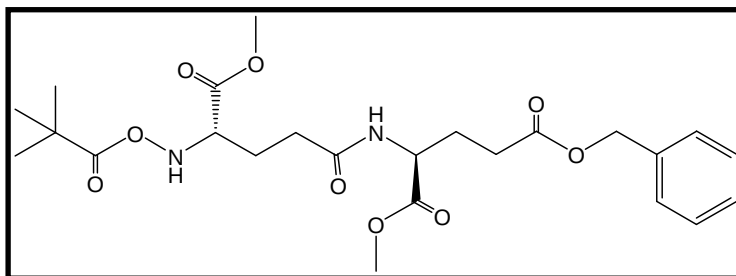


δ_H (400 MHz; CDCl₃) 1.39 (9H, s, *t*-butyl) 1.80-2.28 (2H, m, CH₂(β)) 1.95-2.08 (2H, m, CH₂(β)) 2.30-2.45 (4H, m, CH₂(γ)) 2.61 (6H, s, COOCH₃) 4.21-4.28 (1H, m, CH(α)) 4.53-4.60 (1H, m, CH(α)) 5.52 (1H, d, NH, *J* 7.9) 7.43 (1H, d, NH, *J* 8.0)

Boc- γ -Glu(OMe)-Glu(OBzl)-OMe

m/z (IC) : 495 = (M+H)⁺

Colorless oil

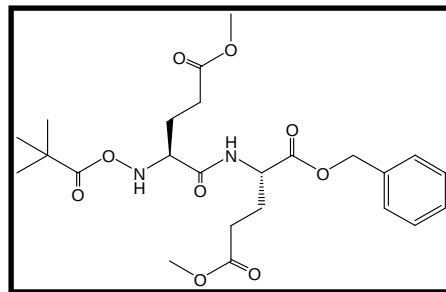


δ_H (400 MHz; CDCl₃) 1.40 (9H, s, *t*-butyl) 1.81-2.06 (2H, m, CH₂(β)) 2.10-2.23 (2H, m, CH₂(β)) 2.23-2.30 (2H, m, CH₂(γ)) 2.35-2.52 (2H, m, CH₂(γ)) 3.69 (3H, s, COOCH₃) 3.70 (3H, s, COOCH₃) 4.21-4.30 (1H, m, CH(α)) 4.54-4.62 (1H, m, CH(α)) 5.08 (2H, s, CH₂-Ph) 5.23 (1H, d, NH, *J* 7.9) 6.51 (1H, d, NH, *J* 8.0) 7.27-7.36 (5H, m, Ph)

Boc-Glu(OMe)-Glu(OMe)-OBzl

m/z (IC) : 495 = (M+H)⁺

White solid, mp 73°C

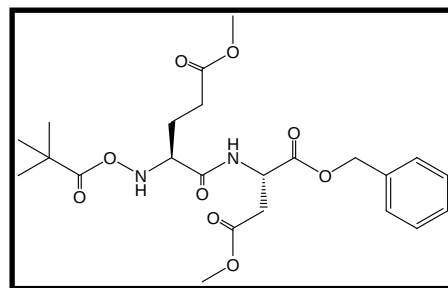


δ_H (400 MHz; CDCl₃) 1.39 (9H, s, *t*-butyl) 1.80-2.09 (2H, m, CH₂(β)) 1.92-2.25 (2H, m, CH₂(β)) 2.31-2.46 (4H, m, CH₂(γ)) 3.62 (3H, s, COOCH₃) 3.65 (3H, s, COOCH₃) 4.11-4.17 (1H, m, CH(α)) 4.76-4.84 (1H, m, CH(α)) 5.11 (2H, s, CH₂-Ph) 5.22 (1H, d, NH, *J* 8.1) 6.97 (1H, d, NH, *J* 8.1) 7.24-7.37 (5H, m, Ph)

Boc-Glu(OMe)-Asp(OMe)-OBzl

m/z (IC): 481 = (M+H)⁺

Colourless oil

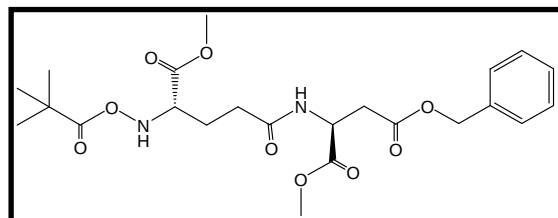


δ_H (400 MHz; CDCl₃) 1.39 (9H, s, *t*-butyl) 1.75-2.1 (2H, m, CH₂(β)) 2.32-2.45 (2H, m, CH₂(β)) 2.76-3.05 (4H, m, CH₂(γ)) 3.59 (3H, s, COOCH₃) 3.65 (3H, s, COOCH₃) 4.10-4.20 (1H, m, CH(α)) 4.83-4.89 (1H, m, CH(α)) 5.01-5.18 (2H, m, CH₂-Ph) 5.23 (1H, d, NH, *J* 7.9) 7.13 (1H, d, NH, *J* 8.0) 7.25-7.35 (5H, m, Ph)

Boc- γ -Glu(OMe)-Asp(OBzl)-OMe

m/z (IC): 481.2 = (M+H)⁺ , 498.2 = (M+NH₄)⁺

White solid, mp 51°C

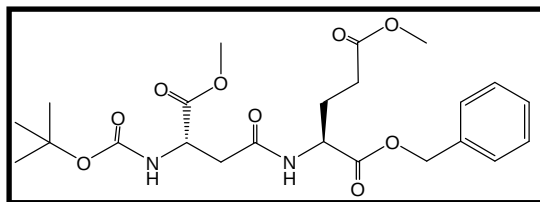


δ_H (400 MHz; CDCl₃) 1.40 (9H, s, *t*-butyl) 1.80-2.20 (2H, m, CH₂(β) (Glu)) 2.25-2.31 (2H, m, CH₂(γ) (Glu)) 2.80-3.04 (2H, m, CH₂(β) (Asp)) 3.58 (3H, s, COOCH₃ (Asp)) 3.69 (3H, s, COOCH₃) 4.23-4.30 (1H, m, CH(α) (Glu)) 4.84-4.89 (1H, m, CH(α)) 5.13 (1H, d, CH-Ph, *J* 12.5) 5.15 (1H, d, CH-Ph, *J* 12.5) 5.23 (1H, d, NH, *J* 7.9) 6.70 (1H, d, NH, *J* 7.8) 7.26-7.36 (5H, m, Ph)

Boc-β-Asp(OMe)-Glu(OMe)-OBzl

m/z (IC) : 481.2 = (M+H)⁺, 498.2 = (M+NH₄)⁺

White solid, mp 103°C

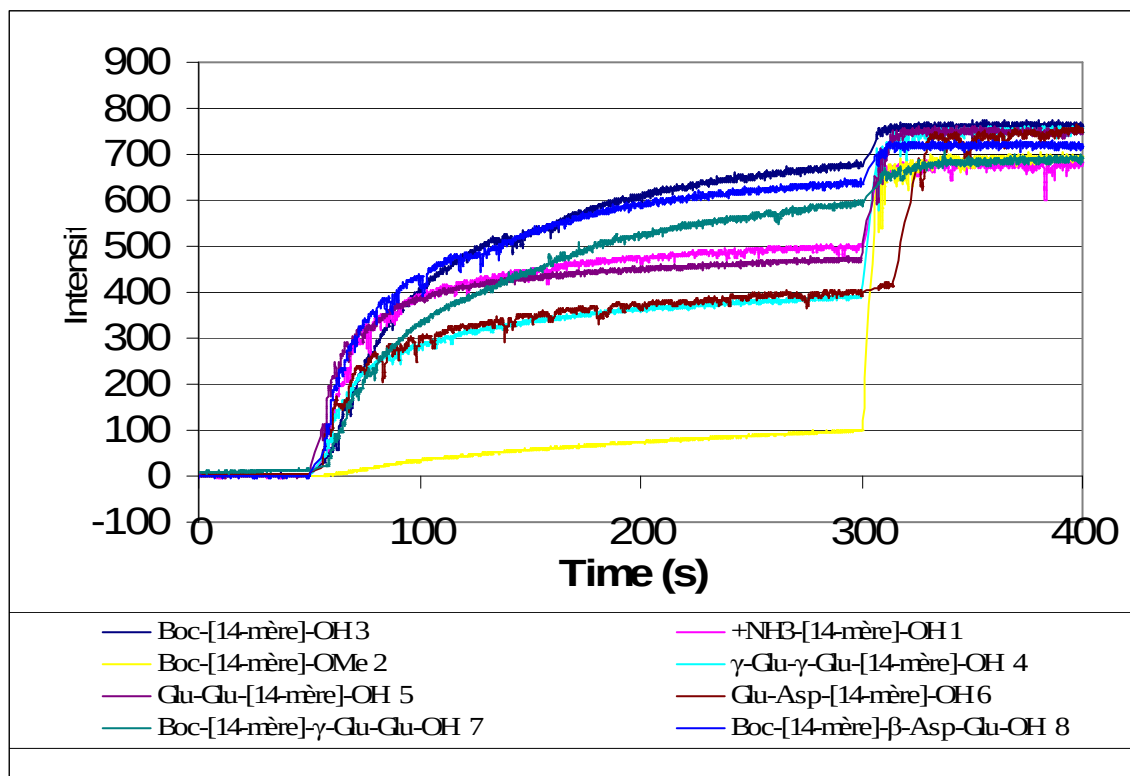


δ_H (400 MHz; CDCl₃) 1.41 (9H, s, *t*-butyl) 1.89-2.23 (2H, m, CH₂(β)) 2.25-2.37 (2H, m, CH₂(γ)) 2.65-2.94 (2H, m, CH₂(β) (Asp)) 3.62 (3H, s, COOCH₃) 3.71 (3H, s, COOCH₃) 4.48-4.54 (1H, m, CH_(α)) 4.57-4.64 (1H, m, CH_(α)) 5.14 (2H, s, CH₂-Ph) 5.69 (1H, d, NH, *J* 7.9) 6.31 (1H, d, NH, *J* 7.9) 7.28-7.37 (5H, m, Ph)

Vesicle lysis experiments

DOPC :Chol (70 :30)

Peptide concentration = 1,25 μM



Peptide concentration = 12.5 μM

